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NOTES ON AN EXTENSIVE DEPOSIT OF OBSIDIAN IN THE YELLOWSTONE NATIONAL PARK.

BY WM. H. HOLMES.

CONSIDERABLE deposits of obsidian and obsidian porphyries had been observed in the national park previous to our visit in the summer of 1878, but no satisfactory exposures of the glassy varieties had been found. In October I had occasion to make examinations of a locality particularly rich in them, situated in the north-western part of the park, near the head of Obsidian or Alum creek, a tributary of the middle fork of Gardiner's river. The crumbling trachytes of this part of the park give, in general, a rounded and monotonous character to the topography. The slopes of the valleys are gentle excepting at points where the glassy rocks predominate.

In ascending Obsidian creek, by way of the newly-cut wagon road which connects Mammoth Hot Springs with the Geyser Basins, we pass first through broad meadows and parked forests. Farther on the valley narrows up and the timber becomes extremely dense. At a point about twelve miles above the junction of the creek with the main stream, there is a narrow gateway known as Obsidian cañon, through which the road and creek pass. From the east side of the valley a low promontory extends forward to the creek and breaks off in an abrupt nearly vertical wall, in which the obsidian rocks are exposed. The road approaches the cañon along the west side of the valley, and crosses to the east side at the lower end of the cañon; in order to avoid the swampy ground that borders the stream it has been carried across the steep débris slopes of the obsidian cliffs. For half a mile it is paved with glassy fragments and lined by huge angular masses of black and banded obsidian rock. From the upper border of the débris slope the vertical cliffs rise to the height of nearly two hundred feet. The lower half is composed of a heavy bed of black obsidian which exhibits some very fine pentagonal columns, somewhat irregularly arranged and frequently distorted, but with perfectly cut faces that glisten in the sunlight. The upper portion of the wall is composed of a much more obscurely columnar mass of impure spherulitic obsidian, the rude faces of the columns being often as much as ten or twelve feet across. To the right and left the columnar character becomes less marked, both in the upper and lower part of the cliff, and farther out seems to be entirely lost, the glassy rocks grading into the gray sanidine trachytes and obsidian porphyries of the surrounding hills.

Extending upward from the edge of the promontory in a moderately gentle slope are four or five hundred feet of obsidian strata that exhibit some most interesting characters. There is no heavy mass of pure glassy rock, but a succession of irregular layers of a dozen or more varieties of spherulitic obsidian, obsidian porphyries and breccias. The colors of these rocks are exceedingly varied, the prevailing blacks giving way to reds, browns, greens and the richest possible marblings and mottlings.

One of the most striking characteristics of these rocks are the spherulitic concretions which occur to a greater or less extent in all the varieties. These bodies seem to prevail in the ashy-like bands or layers which, in the more compact mass toward the base, are frequently contorted, giving the rock the appearance of a banded and contorted gneiss. The ashy-appearing layers are probably composed of the same material as the concretions, since when we split the rock *with* the bands, the surfaces of the gray bands next the glassy layers are simply a connected or coalescent series of nodes or hemispheres which have the usual appearance of the more isolated concretions. Where the concretions are scattered throughout the glassy mass, they are globular or composed of a cluster of globes. They have, in most cases, a distinctly radiated structure, with not infrequently concentric layers near the surface. The interior is gray or pinkish-gray, and the surfaces, pinkish or flesh colored.

In the coarsely columnar part of the wall the spherulites are often a foot or more in diameter and appear much flattened and distorted. It is probable that these irregular forms are produced by the coalescence of a large number of smaller ones, as there are apparently many centers of radiation. Large beds of the rock seem to be made up almost wholly of the concretions, and where decomposed, a mass of coarsely cellular or honey-combed obsidian remains. The brecciated beds consist of an ashy matrix in which are imbedded angular fragments of every variety of the brilliantly-colored spherulitic and ordinary obsidians.

The collection of hand specimens made at this place is very complete, numbering upwards of three hundred. Their examina-

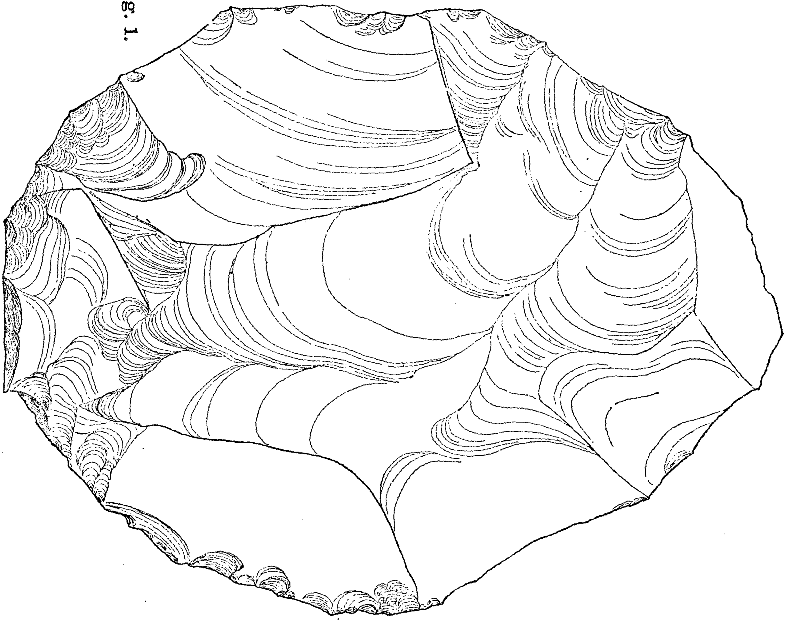

Fig. 1.

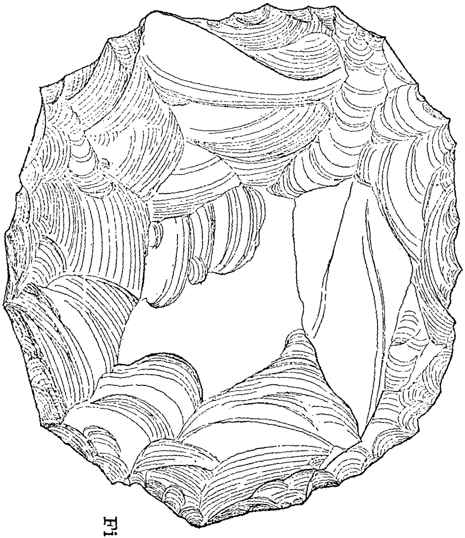

Fig. 3.

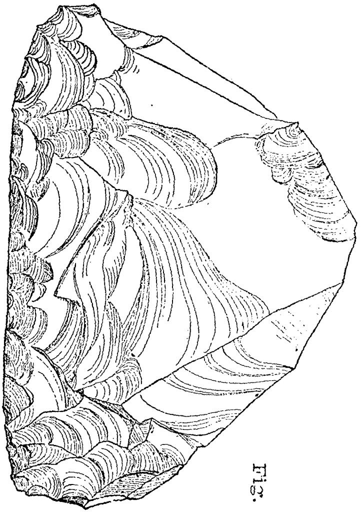

Fig. 2.

tion by specialists in petrography will doubtless develop many new and interesting features, as no equally rich deposit of similar rocks has heretofore been brought to their notice in this country.

Indian Implements.—It occurred to me, while making examinations at this point, that the various Indian tribes of the neighboring valleys had probably visited this locality for the purpose of procuring material for arrow-points and other implements. A finer mine could hardly be imagined, for inexhaustible supplies of the choicest obsidian, in flakes and fragments of most convenient shapes, cover the surface of the country for miles around.

Having climbed the promontory, I observed that an old but quite distinct trail passed along the brink of the ledge and descended the broken cliffs to the valley above and below. In the vicinity of the trail the glistening flakes proved to be more plentiful than elsewhere, and were also apparently gathered into heaps. After a short search a leaf-shaped implement of very fine workmanship was found ; it is made of the black opaque obsidian, and is four inches in length, three inches in width and one-half an inch in thickness; an outline of this implement is given in Fig. 1. Having continued the search as long as the time at my command would permit, I was amply rewarded in the possession of ten more or less perfect implements. Three are leaf-shaped and nearly the same in size as the first specimen found, but imperfect from having been broken. One is somewhat pyramidal in shape, as shown in Fig. 2 ; the bottom is flat, the flaked surfaces extending from the base to the apex ; it is two and a half inches in width and one and three-quarters in height, and is the only specimen in the collection that appears to have been in the least used ; the sharp edge at the base is considerably worn ; Fig. 3 is a top view of the same. Another specimen is triangular in shape with sides about three inches long ; another is rectangular and about three inches wide by four in length, and still another is a rude oval ; nearly all of these implements are imperfect, as it broken or unfinished. If we are to suppose that the great quantities of minute flakes are the fragments left from the manufacture of implements we must conclude that extensive supplies have been obtained here, but by what tribes or at what period it will be quite impossible to determine.